sensory and motor nerve mechanisms, axone reflexes, etc., and of a number of other factors.

5. This gross edema can be prevented by continuous injections of low concentrations of epinephrine and by drugs (strychnine, santonin, picrotoxin, and nicotine) which increase the output of epinephrine from the adrenals.

6. The possibilities of using strychnine in the prevention and treatment of certain clinical edemas, and other features, are discussed.

REGIONAL ANESTHESIA

By C. E. PHILLIPS, M. D., AND ROY H. JOHNSON, M. D., *Los Angeles*

Regional anesthesia to be successful must be carefully studied and practiced.

The advantages of regional over general anesthesia are: Less shock; less systemic effects; reduction of respiratory complications; lower mortality rate.

Its advantages over local anesthesia are: More complete anesthesia with less anesthetic; greater ease and rapidity of anesthetizing large areas; in abdominal work, both parietal and visceral surfaces are rendered anesthetic; enlargement of the field for local anesthesia.

DISCUSSION *by Mary E. Botsford, San Francisco; Eugene H. Barbera, Oakland; W. A. Shaw, Elko, Nevada; William W. Hutchinson, Los Angeles.*

THE chief purposes of an anesthetic are to relieve physical and mental pain. Physical pain, arising from a local interference with a sensory nerve, such as is caused by a surgeon's knife, and mental pain, is the term we apply to the anguish experienced by people who anticipate pain, but who may not be actually in pain.

The ideal anesthetic should possess certain qualities, which are chiefly:

1. Relief of physical pain arising from certain area or areas.

2. Should allay mental pain as we have defined it.

3. Safety. The anesthetic should do no harm to the patient, and should be lasting enough to permit the accomplishment of the ends sought.

4. It should have no subsequent deleterious effects on the patient.

We have no such anesthetic.

Inhalation narcosis is the most common method of inducing anesthesia. It fulfills the first requirement perfectly. It fulfills the second only after the patient is asleep. It does not satisfy the other two requirements satisfactorily in all cases.

In every place where the seriously sick are treated there are a number to whom the administration of an inhalation narcosis jeopardizes their chance of recovery. In this class of persons the use of regional or local anesthesia is advisable where it can be used. Its safety should indicate its employment in a large number of surgical patients.

Regional anesthesia is produced by two different types of procedures—field block and nerve block.

Field block is accomplished by encircling the operative field with a wall of anesthetic solution injected into the tissues. *Nerve block* is accomplished by injecting the anesthetic solution into the nerve or in close proximity to a nerve coming from the area to be anesthetized. Regional differs from local anesthesia, in that the latter has the anesthetic solution injected into the field of operation.

In considering this problem, the first question that arises is: Who shall administer the anesthetic? It must be done by one thoroughly familiar with it. Inhalation narcosis may be administered by the unskilled. Regional anesthesia to be successful requires a thorough familiarity with the technique. Few surgeons have perfected themselves in the technique. Fewer anesthetists have even studied it. If the method is to come to the prominence it apparently deserves, it must be carefully studied and its principles thoroughly mastered by the one who uses it. It will probably be used by the operating surgeon, although there is no reason why the professional anesthetist should not master its principles and make its use extensively available. The regional anesthetist must know the effect and toxicity of the drugs employed; or as has been said, "He should have a thorough knowledge of anatomy, a good training in general surgery, and a complete command of the principles of the method of regional anesthesia."

I shall now consider the subject briefly, as applied to anesthesia of the neck, upper extremities, chest and abdomen, or para vertebral anesthesia. The essentials are:

1. Accurate knowledge of the anatomy of the part, especially of the bony prominences and their relation to nerve trunks and the distribution of the nerves.

2. *Armamentarium*—Instruments should consist of: (a) Dermographic pencil. (b) Syringes: One Luer 2 cc. hypo-syringe with two needles. These needles should be the 20 or 50 m. length and .6 or .7 mm. in diameter. They are used to infiltrate the skin so that the deep injections may be carried out painlessly. Two 12 cc. anesthetic syringes; six infiltrating nerve needles (three of a size and two sizes). Only one size needle is used in a given case, depending on the flesh of the patient. The sizes should be 80 and 100 m. in length and .8 to .9 mm. in diameter. The syringe should be of glass rather than all metal. The metal and glass syringe is preferable because it permits less leakage than the all-glass syringe.

3. The same asepsis is necessary that is required for the operation. *Solutions:* Novocaine in one-half of 1 per cent and 1 per cent solution is used. Adrenalin is added to accentuate and prolong its effect. With the solutions carefully sterilized by boiling, adrenalin is added just before the injection.

Amount of Anesthetic Solution—If the one-half of 1 per cent solution is selected, 250 to 300 cc. may be used with safety. If the 1 per cent solution is used, 125 to 150 cc. may be used, while not more than 30 cc. of the 2 per cent solution should be used. Ten drops of 1:1000 adrenalin is added to each 100 cc. of solution, just before injection. The usual maximum dose of 1:1000 adrenalin solution is thirty drops. This should be reduced in children, arteriosclerotic individuals, in hypertension cases, and others less commonly, when one-half dose or less should be given.

With the needles, syringes and solution prepared, the patient is placed on the operation table,

with the side to be anesthetized uppermost. The work may call for a para vertebral cervical block, a para vertebral dorsal block, a para vertebral lumbar block or a para vertebral sacral block or transacral block, as the last is called. Usually a combination of these is necessary to anesthetize the operative field.

The cervical para vertebral block offers the greatest difficulty. Two routes are offered—the dorsal and the lateral approach. Because of the lack of definite landmarks in the dorsal route, the lateral is usually selected. The dorsal route, passing by the transverse processes, does not incur the risk of injuring the vertebral vessels. On the other hand, there is less chance of finding the nerves and getting a satisfactory anesthesia. If the lateral block is selected, three wheals are raised—one a finger's breadth below the mastoid process, a second over the tubercle of Chassaignac, and a third opposite the superior cornu of the thyroid cartilage. The tips of the transverse processes are located by palpation with the forefinger of the left hand. The right hand passes the needle to the tip of the fourth cervical process, the syringe is connected, and about 5 cc. of a 1 per cent solution is injected; then an equal amount is injected as the needle is withdrawn. Another needle is introduced to the tip of the transverse process just above, and the injection is repeated for the third and second cervical. Care must be taken that the needle strikes the tip of the transverse process. If this is done there is no danger of injuring the vessels. Sub-fascial injections are then made along the posterior margin of the sterno mastoid muscle, 75 cc. of 1 per cent solution being used.

The brachial plexus is blocked in several ways. The para vertebral injection is here more difficult than the injection of the brachial plexus itself. The plexus may be reached through the axillary route. The infra-clavicular approach is probably preferable. In brief, the patient is placed on the table, with the arm of the side to be injected abducted to the extent of 45 degrees and allowed to hang over the edge of the table. The head is turned toward the opposite side. The tubercle of Chassaignac is palpated, and a mark made on the skin over it with the dermographic pencil. A point is selected one finger's breadth mesial to the tip of the coracoid process, and another mark made. These two marks indicate the location and direction of the brachial plexus. The infiltrating needle is inserted in the lower mark and made to advance closely under the clavicle toward the tubercle of the sixth cervical vertebra. When the nerve is struck it is usually felt as a pain in the hand, most frequently in the distribution of the ulnar. The injection of 15 cc. of 1 per cent solution is made. The needle is advanced 3 cm., and 15 cc. more of solution is injected.

The anesthesia of the dorsal and lumbar regions constitute the great majority of cases, and is at the same time the most easy to perform. To assist you in grasping the principles, I have made a sketch from Labat's work, showing the nerve course and distribution in the thoracic region. With the fixed bony landmarks present, the injection of nerve roots becomes an exact procedure. The landmarks are the spinous processes, the ribs and the transverse processes. With the patient lying on the side opposite that to be injected, the back is arched by a pillow under the waist-line. By drawing up the knees, the inter-vertebral spaces are opened to a maximum. The twelfth rib is traced to the vertebra, a perpendicular line is dropped 5 cm. down the midline of the back and finds the spinous process of the twelfth dorsal vertebra. The numbers of the vertebra are reckoned from this. The location of the spinous processes are touched with the dermographic pencil. The area to be anesthetized is mapped out and the nerves supplying this area are to be injected. A line is drawn parallel to the spinous processes and 4 cm. distant, covering the nerves supplying the field of operation. This serves to keep the subsequent injections in line. By keeping them in line, the angles and distances of the injections become uniform and exact. With the patient in the lateral position, the needle is introduced on the 4 cm. line and advanced downward, inward and forward toward the spine, making a 45 degree angle with the surface. The costo-vertebral angle is searched for and found. Remembering the nerve is nearly in the middle of this intercostal space, the needle clears the under edge of the rib at an angle of 45 degrees and passes beyond one-half of 1 cm. If no blood is flowing from the needle, indicating that it is not in a vein, the injection of 5 to 8 cc. of a 1 per cent solution of novocain and adrenalin is begun and distributed about by cautiously moving the point of the needle as the injection is made. The same process is repeated in the lumbar region, except that the transverse processes must be found with the needle and the injection made at an angle of 30 degrees over them instead of under them, as was done in the dorsal region. Instead of going one-half cm. beyond, as in the dorsal region, the needle is passed by the transverse process by 1 cm. The injection is carried out in a fan-shape area, as before mentioned.

For blocking the lumbar and sacral plexuses, the intradural method is much easier, and if carefully performed is probably safe.

In conclusion we may sum up: The advantages of regional over general anesthesia are: (1) Less shock; (2) less systemic effects; (3) reduction of respiratory complications; (4) lower mortality rate.

Its advantages over local anesthesia are: (1) More complete anesthesia with less anesthetic; (2) greater ease and rapidity of anesthetizing large areas; (3) in abdominal work, both parietal and visceral surfaces are rendered anesthetic; (4) enlargement of the field for local anesthesia.

Regional anesthesia, to be successful, must be carefully studied and practiced.

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DISCUSSION

MARY E. BOTSFORD, M. D. (807 Francisco Street, San Francisco)—The comparative merits of general and local anesthesia have been the subject of much discussion, but as there is no one perfect agent or method, safety—the final criterion—demands the adaptation of the anesthetic to the individual case.

Doctors Phillips and Johnson make a strong plea for the use of regional anesthesia rather than inhalation in showing that, while the latter may be administered by the unskilled, the former requires a thorough familiarity with the technic, thus insuring for the patient the safety to be derived from knowledge and experience.

It is to be regretted that specialists in anesthesiology

have not taken up this method. McMechan, the editor of the "Year Book of Anesthesia and Analgesia," has repeatedly advised professional anesthetists to study the administration of local and regional anesthesia, and no doubt the future will see this accomplished.

One advantage to the surgeon, in this combination, is the prevention of delay by the presence of the anesthetist, when it becomes necessary to augment the local anesthesia with general, as, for instance, in many intra-thoracic operations.

EUGENE HOWARD BARBERA, M. D. (Federal Realty Building, Oakland)—It is to be regretted that, generally speaking, we find the surgeons of France, Germany, Italy, and South America becoming more enthusiastic in the art of regional anesthesia than are we of America. This particular field of work calls for exact knowledge of anatomical relations and demands considerable skill. Daily one sees opportunities in the operating-room to apply this particular type of anesthesia, yet the patient is denied this degree of safety because of the operator's inexperience with the method. I most vividly recall the influenza epidemic, at which time a general anesthetic often invited disaster. A surgeon or physician anesthetist skilled in regional anesthesia would have approached these emergency cases with less fear in his heart than we did. One cannot accept this method for all cases, nor should we attempt to carry it out on the neurotic, hypersensitive individual, who most often is best handled under a carefully administered inhalation anesthetic.

Finally, the conclusions of Doctors Phillips and Johnson seem too logical to refute in this present era of surgical endeavor.

W. A. SHAW, M. D. (Pioneer Building, Elko, Nevada)—The paper of Doctors Phillips and Johnson sets forth the advantage of regional anesthesia, as well as very accurately describing the necessary technique.

Nerve block demands special skill, but most surgeons can quite satisfactorily do a field block if they so desire. I feel that the extra trouble involved in administrating field or nerve block is responsible for the fact that it is not used more frequently.

In the larger centers where much surgery is done, the specialist in anesthesia should do this sort of work, while in most hospitals where such specialists are not available, in my opinion the surgeon should familiarize himself with the technique and be able to do regional anesthesia.

In the rather large class of patients known as poor surgical risks, regional anesthesia undoubtedly has its field unopposed by any form of general anesthesia, the administration of which would surely increase the danger of any operative procedure.

WILLIAM W. HUTCHINSON, M.D. (Baker-Detwiler Building, Los Angeles)—No one who has the advancement of the science of anesthesiology at heart could help being intensely interested in this paper. The writers have gone into the technique of the procedure with unusual clearness, which makes the paper of exceptional value. That regional anesthesia has its place in surgery cannot be denied by the most enthusiastic proponents of inhalation anesthesia. This fact is proven by its extensive use, especially in Europe, where it has largely supplanted inhalation anesthesia in some of the clinics. It must be remembered, however, that in these clinics the patients are not given the opportunity of choice. The average American with his high-strung nervous system would prefer unconsciousness during a surgical procedure.

On one point I wish to take issue with the writers of the paper. They state, "Inhalation narcosis may be administered by the unskilled." To my mind this is a mistake often made by surgeons. To allow the administration of an inhalation anesthetic, especially nitrous oxide, by an inexperienced or unskilled person is jeopardizing the life of the patient and the surgeon's reputation.

In conclusion, I should urge the specialists in anesthesia to thoroughly familiarize themselves with the technique of regional anesthesia and be prepared to relieve the surgeon of the actual work in the selected cases where this method is indicatd. The surgeon is often too busy with his surgical problems to develop the technique and assume the responsibility of the anesthetic.

PHILLIPS AND JOHNSON (closing)—Further study will probably define the field of regional anesthesia. There are certain shortcomings of the method which we believe at present are as follows:

It does not fulfill our second requirement as we have defined it—i. e., it does not allay the mental shock. With the critically ill patients where this type of anesthesia seems to be particularly indicated, the mental element is active only to a minor degree. Within our prescribed limits this objection holds good only to a minor degree.

The second shortcoming of the method we would designate its "uncertainty." Even in the most skillful hands the percentage of failures will approximate 20 per cent. In most instances the lack of success is only partial and the administration of a small amount of inhalation anesthetic will permit a painless completion of the operation. There are still others in which the failure is complete, and these are due to a variety of causes.

In all surgical work the welfare of the patient is paramount, but with other things equal the operator working under a severe nervous tension may not exercise the refinement of judgment displayed under more favorable conditions. In other words, when the uncertainties of the anesthetic are added to the responsibilities of a difficult operation, in the presence of a conscious patient the operator's acumen may be affected. We believe the technical difficulties of the method are too great for it to supplant the general anesthetic, except along certain lines.

In conclusion, we desire to express our appreciation to the gentlemen who have discussed this paper, and to Labat, whose technique we have followed closely in our clinical work.

CAESAREAN SECTION FOR HEMORRHAGE

By REGINALD KNIGHT SMITH, M. D., *San Francisco*

The consensus of obstetric opinion has gradually focused to the point of agreement that in only a small percentage of cases of placenta previa is Caesarean section indicated.

Of 4002 obstetric cases that passed through my records prior to December 31, 1922, placenta previa—all forms—occurred twenty-eight times, with a maternal mortality of 0 per cent and a fetal mortality of 6 or 21 + per cent.

DISCUSSION *by K. L. Schaupp, San Francisco; Martha Welpton, San Diego; E. T. Rulison, Sacramento.*

HEMORRHAGE from the birth canal of the pregnant woman, especially during the latter half of pregnancy, is always the cause of alarm and apprehension to the patient and her family, and it is a danger, in varying degrees, to both mother and child.

To the obstetrician it means an added heavy responsibility and the urgent need for early and correct diagnoses of the causes of the hemorrhage, and the prompt institution of the treatment of the patient.

The first thought in the doctor's mind will be placenta previa with its varying types known as lateral, marginal, and central implantations and his mental picture of the unfavorable prognosis in each when the patient is not aided by obstetric art. The risk to the mother rises from a low percentage in the marginal to inevitable death in the complete form; it decreasing to from 3 to 10 per cent under intelligent obstetric procedures, such as Broxton Hick version and the use of bags, applied either with or without previous rupture of the membranes.

The physician's second thought will be of the so-called accidental hemorrhage, carrying as it does a maternal mortality as high as 95 per cent, and decreasing under competent obstetric care to about 60 per cent. And his third thought will be of the risks to the child in each of these conditions, with a pic-